

URETERAL CALCULUS.

WITH A REPORT OF FIVE CASES.¹

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A SURGEON who is called to operate upon five patients suffering from ureteral calculus within as many months, has his attention somewhat forcibly drawn to the importance of diagnosis, and to the difficulties of treatment of this class of cases. In former years calculi arrested in the ureter were considered rare, but since more accurate methods of making a diagnosis in urinary surgery have been available, the frequency with which this condition is present has become more widely appreciated. According to Dr. C. L. Leonard ¹ the use of the Röntgen rays has proved the ratio of ureteral to renal calculi to be as 66 is to 33 in cases where the diagnosis has not been confirmed by operation or recovery of the stone, and as 44 is to 29 in cases where the X-ray diagnosis has been thus confirmed.

Renal calculi in their descent to the bladder are prone to be arrested at three points in their course: (1) Two inches from the pelvis of the kidney, as the ureter bends forward over the psoas muscle; (2) at the brim of the pelvis, where it dips down across the bifurcation of the common iliac artery; and (3) close to the vesical orifice of the ureter. The normal ureter is said to be one-seventh of an inch in diameter at the upper, one-fourth of an inch at the middle, and only one-tenth of an inch in diameter at the lower constriction. In the 44 cases of ureteral calculus referred to by Morris ² the stone was arrested at the upper constriction in 19 instances, at the pelvic brim in ten and at the vesical extremity of the ureter in 15. These figures

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correspond very closely to those given by Bovee,³ who collected 64 operations in which an impacted calculus was removed from the ureter by the extraperitoneal route. Among these, 22 were found near the upper constriction, 17 at the pelvic brim, and 18 close to the bladder; while the remaining stones were found at other portions of the ureter.

The symptoms produced by the passage of a renal calculus are sufficiently familiar, and it only remains, after such symptoms have arisen and have subsided, to determine whether the stone has been forced back into the pelvis of the kidney, has been discharged into the bladder, or whether it has been arrested at some point in its journey. If it escapes into the bladder, symptoms of vesical calculus arise; and if the stone remains in the kidney those of renal calculus continue. The point that chiefly concerns us is to determine at what point of the ureter the stone has lodged. This is not always possible from the symptoms alone. Indeed Mr. Freyer⁴ asserts that the symptoms produced by ureteral calculus are precisely those of renal calculus, except when the stone is lodged in the lower end of the ureter, within an inch or so of the bladder. He admits indeed that tenderness at the seat of impaction may be a guide, but claims that the Röntgen rays are even less satisfactory than in cases of renal calculus. Although I cannot entirely agree with his premises, I heartily endorse his conclusion, which is that the rule of surgery in doubtful cases is to first explore the kidney through the loin, and to pass a sound down the ureter before concluding the operation. If a stone is found in the ureter the wound should be enlarged, and the calculus extracted by appropriate means.

It appears to me, that tenderness at the seat of impaction and the information gained by a technically perfect skiagram, are two very valuable aids to diagnosis. From the symptoms alone it may be possible to determine that renal calculus has existed, and that a calculus is still present, either in the kidney or in the ureter, or in both. It is because we cannot be certain that not more than one calculus is present, that it becomes

necessary to make sure that none is overlooked in the kidney even after the stone found in the ureter has been extracted.

A skiagram to be of value in these cases must throw a shadow of structures less dense than the least dense calculus; and as phosphatic and uric acid stones are by no means dense, it is necessary to see the shadows of the psoas muscle, to make sure that no calculus is present.

If after an attack of renal colic symptoms of renal calculus persist, we may be certain that the stone has at any rate not travelled as far as the lower ureter. In the latter case the symptoms of vesical calculus arise, and though no calculus can be found in the bladder, its location may usually be detected by rectal palpation or by cystoscopic examination.

Although a calculus may remain lodged in the ureter indefinitely without producing serious symptoms, yet such cases are exceptional and were such a calculus to be discovered by chance, it is questionable whether it would not be the surgeon's duty to remove it as a prophylactic measure. Leonard⁵ refers to 26 calculi, found as it were by accident, impacted in the ureter, all of which were safely passed into the bladder while the patients remained under medical care. Cabot⁶ thinks highly of massage in such cases as an aid to the descent of the stone. But it seems to me that the dangers which may ensue from neglect of ureteral calculus are greater than those which attend its removal by operation. Among 21 operations mentioned by Fowler⁷ there were only three deaths; and in reviewing the literature of the last couple of years while preparing this paper, records of 25 operations for ureteral calculus have been found, many of them not in Fowler's list, with only 2 deaths—one in a patient with recurrent carcinoma of the ureter, and the other in my own patient, to be presently mentioned.

If the stone is rough and mammillated it is more apt to excite ulceration and inflammation, although less apt to absolutely occlude the ureter than a smooth stone. On the other hand, while a small stone may be more easily passed by ure-

teral peristalsis and by the *vis a tergo* of the kidney's excretion, yet if it does become arrested it is almost certain to cause hydronephrosis, and give rise to serious symptoms in a short time. When such cases are seen before marked infection is present, the mortality from the operation is slight, as the kidney does not then require removal. The condition of the kidney is really, I think, the main point upon which the success of treatment must depend. In the only one of my cases which terminated fatally, there were calculi impacted in both ureters and the operation which removed the stone from the left ureter was unsuccessful because of the diseased condition of the right, which was not known until the post-mortem examination.

The route to be chosen for the removal of the stone is a matter of much importance. If the stone is known to be near the bladder, it is usually most successfully removed intravesically. In the female the vaginal route has been employed, and the ureter exposed within the layers of the broad ligament. This appears to be less satisfactory a method than the intravesical, and the same may be said of the perineal route in the male. In the female the urethra can be dilated sufficiently to admit suitable forceps, or even the finger, and, after slightly incising the vesical orifice of the ureter, the calculus can usually be extracted without much difficulty. This plan obviates the possibility of a vesico-vaginal or uretero-vaginal fistula, which is not very remote when the vaginal route is chosen. In one of Freyer's patients the ureter was exposed by incising the vagina, but the stone slipped further up the ureter and could not be extracted. It was, however, found in the dressings on the following day; but the patient developed pelvic cellulitis, had a very slow convalescence, and when last seen still suffered from kidney symptoms. In the case of a patient where intravesical manipulations had failed to dislodge the stone, Millet⁸ succeeded in evaginating the obstructed ureteral outlet through the dilated urethra, by means of one finger within the bladder and another in the vagina. With the

parts thus under full control he was able to remove the calculus with success. Crawford⁹ successfully removed from a male patient a calculus measuring one and three-eighth inches in diameter by intravesical dilatation of the ureter. In the third case recorded to-night I found it impossible to extract the stone extraperitoneally, and accordingly opened the bladder above the pubes, and by slightly incising the ureter was enabled to deliver the stone into the bladder and successfully remove it.

But this means will not suffice unless the calculus is lodged very close to the vesical orifice of the ureter; and for those stones impacted more than an inch away from the bladder wall, I would strongly recommend the extraperitoneal operation. This is of course the route selected in cases where the location of the calculus is doubtful, since it affords access to practically the entire length of the urinary tract. In enlarging the lumbar incision downwards care should be taken not to injure the spermatic cord, and at the conclusion of the operation the anterior abdominal wall should be repaired as after an operation for ventral hernia. Even in a child of 3 years Betham Robinson¹⁰ exposed, extraperitoneally, the ureter close to the bladder wall and successfully removed the impacted calculus.

As the peritoneum is stripped back from the iliac fossa, it carries the ureter along with it, and this structure is therefore to be sought on the vesical side of the wound. Proper knowledge of pelvic anatomy is essential to the operation. When a stone is exposed in the ureter, it is proper to try to dislodge it, and to push it either upward into the pelvis of the kidney, or down into the bladder. In doubtful cases, where the kidney alone is first exposed, it may be possible to push the calculus on into the bladder by a bougie, or even to extract it through the kidney by means of the urethral forceps. If it can be pushed on into the bladder it can be satisfactorily removed by the evacuator.

An incision into the ureter itself is usually to be avoided, although in my own opinion the probability of a permanent urinary fistula remaining is exaggerated. But an incision

through the renal cortex, or one directly into the pelvis of the kidney, is to be preferred, since the tract required for drainage is shorter, and the wound may be more closely sutured. But if the calculus cannot be dislodged, it is safer to incise the ureter than to attempt to crush the stone *in situ*. If the calculus is oxalate of lime it may be impossible to crush it, without so injuring the ureter as to cause sloughing; and even if it could be successfully crushed, the detritus would be very likely to give rise to very serious trouble before being completely evacuated. The plan adopted by Mitchell¹¹ and by Corson¹² of placing sutures before extracting the stone, thus using the calculus as a bobbin, may prove advantageous when the wound is deep. It has been my practice to employ when possible two rows of sutures, the first, of catgut, for the submucous tissues, and another of silk, and of the Lembert type, for the muscular walls of the ureter. This plan I am convinced decreases the probability of a urinary fistula persisting. Fiori¹³ has recently recorded a remarkable operation in which he exposed the ureter extraperitoneally, split it for a distance of sixteen centimetres (12 centimetres in its abdominal and 4 centimetres in its pelvic portion) and thus succeeded in extracting 11 or 12 small calculi, the largest weighing 5 grammes, being impacted close to the bladder. He then reconstructed the ureter by sutures using a sound as a guide; and had the satisfaction to have the urinary fistula which resulted close a few days after the operation. Although, as he acknowledges, it was a difficult and somewhat hazardous operation, yet the event justifies his course of action in preferring uretero-lithotomy to nephrectomy, which would have been the only alternative.

Finally, a word may be said about the occurrence of carcinoma in the ureter, as the result of calculus disease. One of the patients I operated on showed the presence of carcinoma in the ureter immediately above the site of impaction, but this would probably have escaped detection if the kidney had not been so diseased as to require removal, and hence to allow a microscopical study to be made of the entire specimen.

Primary cancer of the ureter is admittedly rare. Metcalf and Safford¹⁴ only one year ago were unable to find more than 7 authentic cases on record, including one of their own; and in a majority of these cases no calculus was present. It is probable that most cases of cancer of the ureter have escaped detection, and that as operations on the ureter are more frequently performed, such changes will be more often found. The mere possibility of malignant changes occurring, however, only serves to emphasize the need of prompt removal of the calculus.

The following cases of ureteral calculus are reported with the hope of exciting discussion among the fellows; and among some of the unsettled points on which I am anxious to learn their views, I would particularly mention the following:

The value of the X-ray and the cystoscope with bougieing of the ureter in diagnosis; the significance of localized tenderness. The propriety of exploring the ureter intraperitoneally to locate the suspected stone.

The question of removal of quiescent or latent stones.

The best route for the removal of juxta-vesical stones: whether perineal, vaginal, intravesical, suprapubic, or extra-peritoneal.

The proper treatment of the stone when found: whether it should be pushed on into the bladder, should be crushed, or whether the ureter should be incised.

The best method of suturing the ureter.

Whether nephrectomy is to be countenanced, except for incurable disease.

All of the following cases were operated upon in the German Hospital:

CASE I.—*Ureteral Calculi (Impacted) Removal.*—Miss —, white, aged 22. Admitted July 24, 1905. For past two years has complained of pain in right kidney region, referred downward into inguinal region; pain almost constant, but has had three attacks of severe pain at intervals of six months; duration seven to fourteen days, always accompanied by nausea, vomiting and dizziness.

Abdominal examination. Right kidney movable, not enlarged, no distention or rigidity, no tenderness over abdomen. No X-ray taken.

Operation; July 25, 1905. Vertical incision right ileocostal space; pelvis of the kidney found to be the seat of small hydronephrosis, about the size of a lemon; ureter found dilated to the size of the little finger. The ureter was incised and the fluid allowed to escape, a probe was introduced and a stone palpated; after much effort the stone was brought upwards and delivered through the opening in the ureter at the pelvis of the kidney. Discharged, cured, August 21, 1905.

CASE II.—*Nephrolithiasis Double. Impacted calculi both Ureters.* Mr.—, white, aged 33. Admitted September 7, 1905. On day of admission was seized with sudden acute pain in left lumbar region radiating from near crest of the ileum to the left testicle, testicle retracted. The patient was nauseated, suffered from frequent urination, passing large quantities. Abdomen soft, no rigidity, no pain on pressure over left kidney or course of ureter. No palpable mass. X-ray; dense shadow in region of right kidney.

Operation, Sept. 9, 1905. Oblique incision left flank.

Calculus found impacted in ureter 3 cm. below the pelvis of the left kidney. An effort was made to work the stone up into the pelvis, but failed; the kidney was delivered and an incision made horizontally to the poles into the pelvis and scoop and forceps used to deliver the stone, but failed. On palpation the stone was felt in previous location; an incision was made in the long axis of the ureter over the calculus and the same delivered. The stone was the size of a small pea, irregular and very hard. Before suturing the ureter a probe was passed into the bladder. This patient did well for three weeks, when he was seized with severe pain in the right loin and in a very short time became anuric and died October 10, 1905. Autopsy showed an impacted stone in the right ureter.

CASE III.—*Urethral Calculus. Suprapubic Urethrolithotomy and Lumbar Incision.*—Mr.—, white aged 49. Admitted October 16, 1905. In 1896 was operated for acute appendicitis. In January, 1905, was seized with severe pain in right side referred downward to the right groin. Was operated for abdominal adhesions in June, 1905, but not relieved.

Present illness: Pain is paroxysmal, coming on suddenly at any time, beginning apparently in the right inguinal canal and referred to the right kidney. These attacks are followed almost immediately by vomiting, requiring morphine for relief, but are not followed by irritability of the bladder.

Abdominal examination: Tenderness on pressure at a point on the semilunar line opposite the anterior superior spine. X-ray showed large dense shadow in region of the kidney, and small one near bladder.

Operation October 30, 1905. Curved oblique incision right lumbar region to the anterior spine of the ilium. A stone was located in the ureter in the wall of the bladder. After many attempts to dislodge the stone either into the bladder or by drawing it up into the ureter, all of which were unsuccessful, the wound was covered and the patient placed in the dorsal position and the bladder opened suprapubically; the vesical orifice of the ureter was incised slightly and by pressure from behind the stone was finally brought into view and delivered. The stone was the size of a split pea and very hard. The suprapubic fistula closed on the eighteenth day. Patient was discharged cured November 25, 1905.

CASE. IV.—*Ureteral Calculus*.—Mrs. —, white, aged 32. Admitted November 21, 1905. Patient states that at the age of 21 she had an acute attack of epigastric pain, with vomiting; this attack lasted for one or two days and was associated with severe headache. Had a similar attack six years ago, lasting three days. Patient never vomited blood, always biliary material.

Present history dates back five years, when patient began to suffer with acute pain in the left iliac region radiating to the right loin and back; pain was so acute that anodyne was used for its relief. These attacks occurred at intervals from one to two attacks each month. For one year the patient was free from these attacks.

Six weeks before admission to the hospital attacks of very acute pain, beginning in the right iliac region, radiating to the right lumbar region, occurred every day or night. Large doses of morphine were used for these attacks. Patient was never jaundiced, never noticed blood in the urine.

Upon examination, the right kidney was palpable and mov-

able; left kidney not palpable; no tenderness elicited over either right or left iliac region.

X-ray; dense shadow in region of right kidney, formed body.

Operation, November 25, 1905. Incision right flank, kidney exposed. A stone was found in the ureter. Stone was removed and the kidney, being diseased beyond operative repair, was also removed. Patient was discharged cured December 14, 1905.

CASE V.—*Calculus in Right Ureter*.—Miss —, white. History of right renal colic for five years. Nothing of note in family or personal history other than attacks above referred to. Point of tenderness a little above the line of the right anterior superior spine of the ilium very decided; upon one occasion this tenderness suggested to the mind of the medical attendant the probability of inflammation of the appendix; this was ruled out, however. X-ray, negative.

Operation revealed a stone in the right ureter three inches below the pelvis of the ureter, with stricture of the ureter to the extent of one inch, through which it was difficult to pass the smallest probe. After incising the ureter above the stricture the stone was removed. The ureter between the stricture and the kidney was dilated to the size of the little finger. The kidney was so diseased that it was removed. The patient made an uneventful recovery. Microscopical examination of the ureter showed clearly carcinomatous change.

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